# Symbolab Trigonometry Cheat Sheet

#### **Basic Identities:**

• 
$$tan(x) = \frac{\sin(x)}{\cos(x)}$$

• 
$$tan(x) = \frac{1}{\cot(x)}$$

• 
$$\tan(x) = \frac{\sin(x)}{\cos(x)}$$
  
•  $\tan(x) = \frac{1}{\cot(x)}$   
•  $\cot(x) = \frac{1}{\tan(x)}$ 

• 
$$\cot(x) = \frac{\cos(x)}{\sin(x)}$$
  
•  $\sec(x) = \frac{1}{\cos(x)}$   
•  $\csc(x) = \frac{1}{\sin(x)}$ 

• 
$$\sec(x) = \frac{1}{\cos(x)}$$

• 
$$\csc(x) = \frac{1}{\sin(x)}$$

#### **Pythagorean Identities**

• 
$$\cos^2(x) + \sin^2(x) = 1$$

$$\bullet \quad \csc^2(x) - \cot^2(x) = 1$$

## **Double Angle Identities**

• 
$$\sin(2x) = 2\sin(x)\cos(x)$$

$$\bullet \quad \cos(2x) = 1 - 2\sin^2(x)$$

• 
$$\cos(2x) = 2\cos^2(x) - 1$$

• 
$$\cos(2x) = \cos^2(x) - \sin^2(x)$$
  
•  $\tan(2x) = \frac{2\tan(x)}{1-\tan^2(x)}$ 

$$\bullet \quad \tan(2x) = \frac{2\tan(x)}{1-\tan^2(x)}$$

#### Sum Difference Identities

• 
$$\sin(s+t) = \sin(s)\cos(t) + \cos(s)\sin(t)$$

• 
$$\sin(s-t) = \sin(s)\cos(t) - \cos(s)\sin(t)$$

• 
$$\cos(s+t) = \cos(s)\cos(t) - \sin(s)\sin(t)$$

• 
$$\cos(s-t) = \cos(s)\cos(t) + \sin(s)\sin(t)$$

• 
$$\tan(s+t) = \frac{\tan(s) + \tan(t)}{1 + \tan(s) \tan(t)}$$

• 
$$\tan(s+t) = \frac{\tan(s) + \tan(t)}{1 - \tan(s) \tan(t)}$$
• 
$$\tan(s-t) = \frac{\tan(s) - \tan(t)}{1 + \tan(s) \tan(t)}$$

### **Product To Sum Identities**

• 
$$\cos(s)\cos(t) = \frac{\cos(s-t)+\cos(s+t)}{2}$$

• 
$$\cos(s)\cos(t) = \frac{\cos(s-t) + \cos(s+t)}{2}$$
  
•  $\sin(s)\sin(t) = \frac{\cos(s-t) - \cos(s+t)}{2}$ 

• 
$$\sin(s)\cos(t) = \frac{\sin(s+t)+\sin(s-t)}{\sin(s-t)}$$

• 
$$\sin(s)\cos(t) = \frac{\sin(s+t)+\sin(s-t)}{2}$$
  
•  $\cos(s)\sin(t) = \frac{\sin(s+t)-\sin(s-t)}{2}$ 

## **Triple Angle Identities**

• 
$$\sin(3x) = -\sin^3(x) + 3\cos^2(x)\sin(x)$$

$$\bullet \quad \sin(3x) = -4\sin^3(x) + 3\sin(x)$$

• 
$$\cos(3x) = \cos^3(x) - 3\sin^2(x)\cos(x)$$

• 
$$\cos(3x) = 4\cos^3(x) - 3\cos(x)$$

• 
$$\tan(3x) = \frac{3\tan(x) - \tan^3(x)}{4x^3 + \tan^3(x)}$$

• 
$$\tan(3x) = \frac{3\tan(x) - \tan^3(x)}{1 - 3\tan^2(x)}$$
  
•  $\cot(3x) = \frac{3\cot(x) - \cot^3(x)}{1 - 3\cot^2(x)}$ 



**Function Ranges:** 

1 direction Rangesi						
sin(x)	$-1 \le y \le 1$	arcsin(x)	$-\frac{\pi}{2} \le y \le \frac{\pi}{2}$			
cos(x)	$-1 \le y \le 1$	arccos(x)	$0 \le y \le \pi$			
tan(x)	$\infty < y < \infty$	arctan(x)	$-\frac{\pi}{2} < y < \frac{\pi}{2}$			
$\cot(x)$	$\infty < y < \infty$	arccot(x)	$0 < y < \pi$			
csc(x)	$-\infty < y \le 1$	arccsc(x)	$0 \le y < \frac{\pi}{2} \cup \pi \le y < \frac{3\pi}{2}$			
sec(x)	$-\infty < y \le 1 \cup 1 \le y < \infty$	arcsec(x)	$-\pi < y \le -\frac{\pi}{2} \cup 0 < y < \frac{\pi}{2}$			

**Function Values:** 

Function Values:						
	sin(x)	$\cos(x)$	tan(x)	cot(x)		
0	0	1	0	Undefined		
$\frac{\pi}{6}$	1	$\sqrt{3}$	$\sqrt{3}$	$\sqrt{3}$		
6	$\frac{\overline{2}}{2}$	2	$\frac{\sqrt{3}}{3}$			
$\frac{\pi}{4}$	$\frac{1}{2}$ $\frac{\sqrt{2}}{2}$	$\frac{\overline{2}}{\sqrt{2}}$	1	1		
	2	2				
$\frac{\pi}{}$	$\frac{\overline{2}}{\sqrt{3}}$	$\frac{2}{\frac{1}{2}}$	$\sqrt{3}$	$\sqrt{3}$		
$ \frac{\pi}{3} $ $ \frac{\pi}{2} $ $ \frac{2\pi}{3} $ $ \frac{3\pi}{4} $ $ \frac{5\pi}{6} $	2	$\overline{2}$				
$\frac{\pi}{}$	1	0	Undefined	3 0		
2		1				
$\frac{2\pi}{}$	$\sqrt{3}$		$-\sqrt{3}$	$\sqrt{3}$		
3	2	2		3		
$\frac{3\pi}{}$	$\frac{\sqrt{3}}{2}$ $\frac{\sqrt{2}}{2}$	$-\frac{1}{2}$ $-\frac{\sqrt{2}}{2}$ $-\frac{\sqrt{3}}{2}$	$\sqrt{3}$	$ \begin{array}{c c} -\frac{\sqrt{3}}{3} \\ -\sqrt{3} \end{array} $		
4	2	$-{2}$	$-{3}$			
$5\pi$	$\frac{1}{2}$	$\sqrt{3}$	-1	-1		
π	0	-1	0	Undefined		
$\frac{7\pi}{}$	$-\frac{1}{2}$	$\sqrt{3}$				
6	2	$-{2}$				
$5\pi$	$-\frac{1}{2}$ $-\frac{\sqrt{2}}{2}$	$ \begin{array}{r} -1 \\ -\frac{\sqrt{3}}{2} \\ -\frac{\sqrt{2}}{2} \\ -\frac{1}{2} \end{array} $				
4	$-{2}$	$-{2}$				
$4\pi$	$\sqrt{3}$	_ 1				
3						
$3\pi$		0				
2	-					
$\frac{5\pi}{}$	$\sqrt{3}$	$\frac{1}{2}$				
3	$-\frac{2}{2}$ $\sqrt{2}$	2				
$\frac{7\pi}{}$	$\sqrt{2}$	$\sqrt{2}$				
4		2				
$ \frac{\pi}{7\pi} $ $ \frac{7\pi}{6} $ $ \frac{5\pi}{4} $ $ \frac{4\pi}{3} $ $ \frac{3\pi}{2} $ $ \frac{5\pi}{3} $ $ \frac{7\pi}{4} $ $ \frac{11\pi}{6} $	$-\frac{1}{2}$	$ \frac{\sqrt{2}}{2} $ $ \frac{\sqrt{3}}{2} $				
6	2	2				